

ELECTRONICALLY COMMUTABLE MOTOR HAVING OVERLOAD PROTECTION

Field Of The Invention

The present invention relates to an electronically commutable motor whose output stages are controllable by an electronic control unit, using PWM signals, and are feedable from a supply voltage source.

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Background Information

In motors of this type, the electronic control unit supplies power to the motor output stages, which ordinarily include semiconductor switches and windings. The control unit is usually designed for bidirectional operating conditions. If the motor drives a fan, for example, the current rises in proportion to the squared motor speed, while the motor speed rises in linear proportion to the supply voltage. If fans of this type are used in a motor vehicle and fed from the vehicle battery, the motors are designed for a nominal voltage of 13 V, for example, but must operate dependably at a voltage of up to 16V, for example. The fan must provide the necessary air capacity at the nominal voltage. The higher air capacity available at higher battery voltages is therefore superfluous. However, these stipulations mean that the motor and the electronic components must be designed for higher performance ratings around 16V.

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Summary Of The Invention

An object of the present invention is to provide an electronically commutable motor that is designed so that its electronic components are limited to the load specified by the nominal voltage and are protected against overloading even when the supply voltage exceeds the nominal voltage.

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This object is achieved according to the present invention by enabling the pulse

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width of the PWM control signals for the output stages to be reduced, at least upon exceeding the motor nominal voltage, to a width that prevents overloading of the motor and electronic components by limiting the motor output, as a function of the magnitude of the supply voltage and the specified setpoint for the PWM control signals.

By influencing the PWM control signals for the motor output stages in this manner, the maximum load is defined by the nominal voltage and the maximum setpoint and cannot increase any further even with high supply voltages. The motor and its electronic components therefore need to be designed only for this load and are protected against overloads.

A design of this type also enables the pulse width to be reduced in such a way that the pulse width is reduced in linear or nonlinear proportion to the rising supply voltage; however, it is also possible for the pulse width to decrease at an increasing rate with an increasing specified setpoint and rising supply voltage. This latter instance advantageously makes use of the fact that a smaller specified setpoint reduces the load on the motor and its components, due to lower currents.

According to one embodiment, the pulse width reduction may be incorporated into the control unit by assigning the control unit a correction unit that forwards, to the motor output stages, the PWM control signals for the motor output stages determined according to the specified setpoint, either unchanged or as reduced PWM control signals, as a function of the magnitude of the supply voltage; and by enabling the PWM control signals for the motor output stages determined by the control unit on the basis of the specified setpoint to be forwarded unchanged to the output stages until the motor nominal voltage is reached, with their pulse width being reduced according to the setting provided by the correction unit only when the supply voltage begins to increase.

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Note, in addition, that pulse width ID may be corrected by control unit STE itself, and speed N may be used instead of supply voltage U_{batt} and/or in addition to supply voltage U_{batt} as the parameter for reducing pulse width ID.